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FINAL REPORT

Opportunities for Using Blended Cement in Central America and the Caribbean

Workshop for the Central American and Caribbean Region

Environmental Export Council

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BACKGROUND

In December 1999, the Environmental Export Council (EEC) hosted a Cement Environmental Business Exchange in the U.S. (Washington, DC, Dallas, and Los Angeles) to introduce Central American and Caribbean cement manufacturers to technology and innovations in cement manufacturing. A key focus was on pollution prevention and energy efficiency, including mitigating CO₂ emissions and improving the quality of cement. EEC developed a follow-up workshop in Guatemala City to promote the use of blended cement in the region, a less energy-intensive product than Portland cement, and one which allows for the use of less costly inputs, including various by-products such as fly ash.

The *Opportunities for Using Blended Cement in Central America and the Caribbean (Oportunidades para el Uso de Cementos Mezclados en Centroamérica y el Caribe)* workshop forms part of the collaboration between EEC, a project of Concurrent Technologies Corporation (CTC), and the United States Agency for International Development (US-AID) on the Latin America Initiative for Environmental Technology (LA-IET). The LA-IET is a cooperative agreement which acts as an umbrella program for various activities designed to promote private sector investment in environmentally sustainable development in the region. The vehicle for achieving this objective is a series of innovative partnerships to leverage resources from governments, the private sector, industry associations, and non-governmental organizations.

This workshop involved representatives from EEC, the Alliance to Save Energy, Marasco Newton Group (MNG), the National Institute of Standards and Technology (NIST), cement manufacturers and purchasers from Central America and the Dominican Republic, and Central American representatives from government agencies and chambers of construction and industry. The purpose of the workshop was to increase awareness within the cement industry about the economic and environmental benefits of using blended cement for appropriate applications. The agenda included the following key topics: (1) Economic and environmental benefits of using blended cements; (2) Applications for blended cements; (3) Comparison of cement properties and manufacturing levels within the region; (4) Quality standards; (5) Materials available within the region to create blended cement products.

The workshop took place in Guatemala City on Thursday, June 1, 2000, with local host support from the Chamber of Industry of Guatemala, and Cementos Progreso, the cement manufacturer in Guatemala.

Main Objectives

The main objectives for this workshop were as follows:

- Support efforts of cement manufacturers in Central America and the Dominican Republic to reduce CO₂ emissions.
- Facilitate the creation of strategic alliances for the transfer of information and technology among the private sector in the US, Central America, and the Dominican Republic.
- Build on the successes of the business exchange and LA-IET activities to further develop the institutional capabilities of cement manufacturers, industry associations, and government officials to address environmental concerns.

Workshop-Specific Goals

The following include the workshop-specific goals, focused on the regional cement industry's efforts to mitigate environmental impacts and conserve resources:

- Heighten awareness of the impact of the cement manufacturing process on the global environment
- Increase understanding about the current market, manufacturing levels, and applications of blended cement in the region
- Provide information related to decision-making for cement purchases
- Enable opportunities for building collaborative relationships among US representatives and key regional groups, such as cement and concrete companies
- Develop action plans to apply new understanding to current and future manufacturing process improvements and decision-making by cement buyers.

OVERVIEW OF WORKSHOP:

The following are summaries of the various components of the workshop and contributed to its success.

1. Workshop Structure

The *Opportunities for the Use of Blended Cement in Central America and the Caribbean* workshop was designed as a venue for the exchange of information not only between technical experts and professionals within the region and those from the US, but also among the participants themselves. Professionals from six Central American countries and the Dominican Republic received technical information through presentations and materials, and engaged in continual dialogue throughout the day through question and answer periods, a roundtable country report session, and a Participant Action Planning (PAP) session. As with other LA-IET activities developed by EEC, the workshop promoted the formation of innovative partnerships, and for leveraging public and private resources. The purpose in this was to share information related to energy efficient and environment-friendly technologies and processes for the production of higher performance cement, and to foster sustainability in communication and collaboration across borders within the industry.

2. Participants

For this event, EEC targeted plant managers within cement facilities in Central America and the Dominican Republic, as well as the primary construction firms, concrete manufacturers, chambers of construction and industry, government ministries (environment, commerce and industry, and public works), and civil engineering professionals in the region. A total of 43 professionals attended the workshop, representing seven countries, 15 cement and concrete companies, 10 government offices, and four industry chambers and associations. The majority of the participating companies and organizations provided in-kind support for the event by covering the costs for staff time, materials and/or travel of their representatives to the event.

A brief summary of the participation follows below:

Country	Participating Company/Org.
COSTA RICA	Cementos del Pacífico, SA * (CEMPASA)
DOMINICAN REPUBLIC	Cementos Nacionales, SA
EL SALVADOR	Cementos de El Salvador (CESSA)
	CONISA
	Oficina de Planificación del Área Metropolitana de El Salvador
GUATEMALA	Asesoría Basterrechea y Asociados, SA
	Cámara de Industria de Guatemala
	Cámara Guatemalteca de Construcción

GUATEMALA (continued)	Cementos Progreso, SA ** °
	Centro de Investigaciones de Ingenieria
	Comisión Nacional del Medio Ambiente
	Consultoría y Tecnología Ambiental, SA
	Ingenieros Consultores de Centroamérica
	Ministerio de Comunicaciones (COVIAL) / Dirección General de Caminos
	Municipalidad de Guatemala
	Unidad de Construcción de Edificios del Estado
	Sismoconsult
HONDURAS	Preesforzados y Construcciones, SA
	Cámara de Comercio e Industria de Cortés
	Cámara Hondureña de la Industria de la Construcción
	Cementos del Norte SA de CV **
	Secretaría de Recursos Naturales y Ambiente
NICARAGUA	Cementos de Nicaragua
PANAMÁ	Cementos Panamá, S.A.
	Cemex Panamá *
	Concreto S.A.
7 Countries	43 Participants

* Denotes cement manufacturer owned by CEMEX

** Denotes cement manufacturer owned or affiliated with Holderman

° Denotes company is only cement manufacturer in country

All others are concrete producers, distributors, government representatives, industry representatives, etc.

In addition, a representative of the USAID Regional Urban Development Office (RUDO) for Latin America and the Caribbean was in attendance at the event.

3. Partner Organizations/Groups

EEC collaborated with MNG, the Alliance to Save Energy, and in-country partners, the Cámara de Industria de Guatemala and Cementos Progreso to develop and implement this activity.

4. Presenters & Sessions

Walter E. Weaver, Project Manager, Environmental Export Council (EEC), *Concurrent Technologies Corporation (CTC)*, presented the first session for the activity, “Summary of CORAMA Projects and Pollution Prevention,” which provided background information on the Latin America

Initiative for Environmental Technology (LA-IET) and the Comité Regional del Medio Ambiente para Centroamérica (CORAMA). In addition, the discussion reviewed USAID pollution prevention priorities and strategies for Latin America, and key concepts of cleaner production and its related benefits. This overview provided background to the activity's development and set the stage for the day's events.

Denise Christiansen, Facilitator/Trainer, Marasco Newton Group (MNG), moderated the workshop and facilitated discussions during the event, including the "Perceptions of Blended Cement," the "Roundtable Discussions" and the "Participant Action Planning (PAP)" sessions. The key points and questions raised by the participants during these discussions are noted in the "Discussions" and "Participant Action Plans" sections in this report. These sessions provided an opportunity for participants to share their reactions or experiences related to the topics presented, and outline specific actions they will take to apply the knowledge to their current projects and professional responsibilities.

Kevin James, Project Manager, Alliance to Save Energy, presented "Introduction to the Topic of Climate Change and How it Relates to the Cement Industry," which provided background information on climate change—including the greenhouse effect, CO₂ emissions, and global warming—as it relates to the cement industry. He also highlighted opportunities to save resources and reduce emissions. The purpose of this presentation was to more clearly define how the cement industry impacts the environment, and compare this impact to those made by other industries and/or energy uses.

Dale Bentz, Chemical Engineer, Building Materials Division, National Institute of Standards and Technology (NIST), US Department of Commerce, provided a presentation on Blended Cements and the NIST Partnership for High-Performance Concrete Technology (PHPCT) Program. This discussion focused on the work of the PHPCT to develop, demonstrate and implement a system for predicting and optimizing the performance and life-cycle costs of high-performance cements. As with the Cement Environmental Business Exchange held in December of 1999, participants again noted that the NIST presentation was extremely valuable because the type and extent of research being done is much more extensive than what is being conducted in the region.

Stephanie Campbell, Alliance to Save Energy, talked with participants about "Market Mechanisms for Energy Efficiency and Potential Applications to the Cement Industry." The key topics of the presentation were the development of labeling programs, energy efficiency standards, and certification processes related to environmentally friendly products. The cement buyers present were particularly interested in the concept to develop greater product information and increased consumer awareness to support 'greener procurement.'

César Constantino, Ministerio de Obras Públicas, República de Panamá, presented "The Decision-Making Process for Purchasing Cement." This presentation highlighted major construction projects in Panama, and related them to the process of making, buying and selling cement in the country. His primary message was that education is key to inform engineers, architects, government officials and contractors of the availability, properties and performance of blended cements. He emphasized that government must play a crucial role in supporting the acceptance of new building materials and serving as an objective party in ensuring that the specifications meet the needs and interests of major infrastructure projects.

Emilio Beltranena, Cementos Progreso, presented "Proposal for Central American Standards for Cement." This presentation outlined one of the topics of greatest interest by the participants: the harmonization and modernization of cement standards within the region to bring them in line with international standards, and to create a standard way of classifying and understanding the necessary

characteristics of cements within the region. This discussion, along with participants' sharing of information on regulations and standards currently in place and used in their countries, was an area noted in many of the Participant Action Plans.

5. Discussions

The following are notes on various discussions held throughout the day:

Participants' Key Questions Regarding Blended Cement (AM session)

The participants noted that their primary concerns and/or points of interest related to blended cement were the following:

- Available materials
- Durability
- Relative benefits or disadvantages of additions to concrete versus mixed cement
- Differences in the applications of blended versus Portland cements
- Forging of blended cements
- Standards
- Material reuse in blended cements
- Levels of resistance/strength of blended cements
- How to introduce laws related to the use of blended cements
- Comparative prices of blended cements
- Mixing metals in blended cements
- Factors taken into consideration in the procurement and purchasing of cement products
- Plastic flows

Roundtable (AM session)

During the Roundtable discussion, one participant from each country served as a representative to briefly describe blended cement use in his/her local market. The following are notes on the information shared during this session.

Costa Rica – Cementos del Pacífico produces a modified Portland cement with 5-20% additives.

Dominican Republic – Cementos Nacionales in the Dominican Republic, one of two cement producers in the country, has Type 1 (96% of production) and modified Type III (4% of production) Portland cement products. No additives are currently used.

El Salvador - CESSA began to produce blended cement in the 1980's and their products were met with resistance because their customers had been conditioned to use pure Type I Portland cement. The company has worked to develop standards in El Salvador based on ASTM. In 1995, they began to emphasize the properties of cement based on performance rather than on content. Regarding types of additives used, they have primarily looked at pozzolans—volcanic ash or other substances used to create hydraulic cement—and limestone.

Guatemala - In 1985, Cementos Progreso began to bag mixed cement products which contained a volcanic additive, as allowed by national standards. The company began by using 5% additive although the standard allows up to 15% to be blended. They have tried to develop two different cements: one for

general use with up to 15% additives called Cement 4000, and a 'pure' Portland cement called Cement 5000 for high-end uses. The company is also trying to improve the quality of clinker used to have a stronger product. The traditional energy sources in Guatemala are thermal and hydraulic, but they are now beginning to use coal, which produces an ash that could potentially be used in the future to create a blended cement. The company has tested the ash in the past to create a product but has not been successful so far.

Honduras - In 1996, Cementos del Norte began to use blended cements to support a project to develop a highway, which was being developed by an Italian company. The construction company asked that Cementos del Norte produce a cement that would not have reactive aggregates. In response, they created a cement with low alkaline content (0.6%) which met the standards for a Type I cement. A sample of this cement was tested in a lab, CTL, in Denver, CO, USA, and was found to be highly expansive. A new solution was developed to use a high concentration of a pozzuolanic material to lower the expansion. The resulting product, a modified Portland cement, has less than 15% blended materials. Today in Honduras, a debate exists because concrete companies' purchase cement based on their high levels of resistance and strength, while cement companies' are constrained by time and volume of production. It was noted that many professionals in the concrete and construction companies do not know all the standards, and as a result, simply request pure Portland cement.

Nicaragua - Cementos de Nicaragua began to create a blended cement in 1993 that complied with the ASTM standard; limestone and pozzuolanic materials were used as additive materials to approximately 16% of the product. The blended product was met with opposition from contractors because it was seen as not being a 'pure,' Portland cement product. Now, 100% of the cement sold is blended with 15-16% being additive materials. There are no national standards in Nicaraguan, only international standards.

Panamá - Since 1997, Cementos Panamá has produced blended cements. There was a boom in construction following the invasion. The cost of the product was high due to a rise in energy prices, and thus research into lowering energy consumption has been a priority. Regarding the problems associated with forging blended cements, they have studied pozzolan and limestone, and have applied both to the same projects. The company currently has a production line with 3-5% limestone and 6-7% gypsum, and has thus reduced manufacturing costs, and reduced CO₂ emissions. Cementos Panamá is now interested in ways to facilitate the development of environmental legislation. Their production goal is to use 8% limestone and 7% gypsum, and maintain the quality of the cement products produced to ensure a standard strength for the concrete companies which purchase the products.

In 1998, Cemex Panamá began to increase the production of blended cements. They looked for additives, in particular, pozzolan, and were not successful. They moved to using limestone in 1998 in about 35% of the cement produced. The company is becoming more competitive in pricing and outreach in Panama, and is now looking to markets traditionally held by Cementos Panamá and competitors in Costa Rica.

6. Participant Action Plans

The following is a summary of the most common goals set by participants in order to apply the information and experience gained through the workshop to their own responsibilities in their plants:

i. Increased Production and/or Use of Blended Cements

- Increase the percentage of additions used in blended cements and/or begin manufacturing of blended cements, to decrease the amount of clinker used.
- Research other potential additive materials.
- Relate use of blended cements to construction guidelines to promote their use, and identify best uses for cements based on their properties and the project requirements.
- Promote the use of high-performance cement made with local materials and superplasticisers.
- Diversify the types of cements made in the plant.
- Use fly-ash and slag in addition to pozzolan.
- Develop pre-fabricated products and blended cement products to test against existing cements.

ii. Improved Manufacturing Process

- Improve clinker performance in terms of physical-chemical properties.
- Improve quality control in manufacturing to produce excellent and competitive products.
- Find out more about industry advancements in temperature resistance in cements.
- Stay up-to-date on cement technologies.

iii. Improved Energy Use and Lowered Environmental Impacts

- Reduce the release of CO₂ and other greenhouse gases, and reduce the environmental impact made by the cement manufacturing process.
- Promote the use of blended cements and reduced energy use.
- Increase use of alternative fuels, look for energy sources with less CO₂ emissions, and optimize energy use.
- Look into the situation of forests in the region to learn more about how they counterbalance CO₂ emissions.
- Use concrete in building roads [to reduce ambient heat].

iv. Training and Outreach

- Prepare a summary of what was learned during the workshop and present that to senior management in the participating companies to promote changes to be made to production.
- Use the information learned to train employees, chambers of commerce or industrial associations, university personnel, and others.
- Raise consumer awareness of the benefits of using blended cements.

v. Standards

- Foster the development of Central American-wide standards for cements that would allow a higher percentage of additives and/or take a leadership role in pushing through standards within their own countries.

7. Evaluations

The following is a summary of participant responses to questions asked to evaluate the workshop:

Q.: Was the workshop conducted at the appropriate technical level?

Yes: 99.99% No: .01%

Q: What relevancy does this type of workshop have to efforts to transfer technologies and management techniques to countries/region?

Very much: 100% Some: 0% None: 0%

Q: How will you use the information gained during the workshop?

- Apply to efforts to develop standards and work toward Central American-wide standards for cement products.
- Disseminate information and/or train students, coworkers, plant personnel and/or clients on related topics.
- Improve cement manufacturing process including integrating materials recycling and/or reuse programs.
- Increase the use of additions to cement and reduce the amount of clinker used.
- Invest in laboratory equipment for the company to improve research capabilities and/or work with NIST to obtain information to support greater materials use.
- Foster the use of blended cements in construction and include specifications for these types of cements in projects.
- Work to obtain a higher quality of product in the pre-fabrication plants.
- Train plant personnel to look for ways to improve the product and manufacturing process, and reach cleaner production goals.
- Use and optimize additives in cements.
- Increase the environmental awareness of plant personnel and end-users.
- Maintain contact with the groups involved in the workshop to continue to share information and communicate regarding this initiative.

Q: What are suggestions for continuous improvement of activities?

- Expand the event focus to more fully include concrete producers.
- Make greater use of simultaneous interpretation (non-fluent Spanish speakers should present in English).
- Dedicate more time to the event to cover topics in greater depth (perhaps create a 2-day event).
- Use more up-to-date data in the presentations and more case studies, perhaps including examples from Europe where there is more experience with blended cements.
- Have more industry representatives as presenters and have a concrete expert as a speaker.
- Include additional data on how the industry impacts the environment and health.
- Regarding expensive cement technologies, provide information on how to obtain technical cooperation to gain access to this; likewise, put emphasis on technologies which are more accessible.